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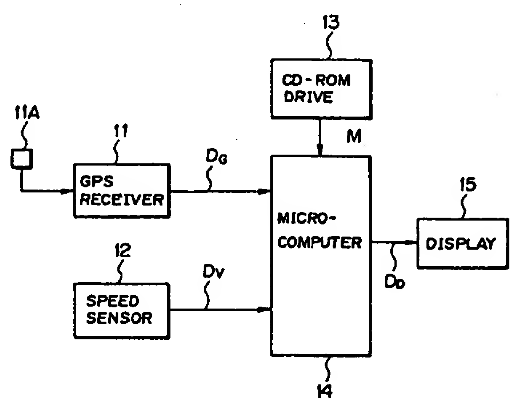
(54) GPS navigation system with selective updating.

(57) A navigation system includes a position measurement receiver for receiving an electric wave for use in position measurement transmitted from a satellite and for generating current position data at each predetermined position measurement timing. The current position data indicates the current position of a movable body in which the navigation system is installed. A storage unit stores latest current position data generated by the position measurement receiver in lieu of previous current position data so that the current position data stored in the storage unit is updated at the predetermined position measurement timing. A speed detection sensor outputs speed data indicating a speed of movement of the movable body. An update inhibiting unit determines whether or not the movable body is maintained in a stationary state on the basis of the speed data, and inhibits the latest current position data from being stored in the storage unit so that updating of the current position data stored in the storage unit is inhibited when it is determined that the movable body is maintained in the stationary state.

F I G. 1



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shown) through an antenna 11A, and generates GPS position measurement data D_G from the received electric wave. The vehicle speed sensor 12 counts vehicle speed pulses dependent on revolutions of a wheel shaft or the like, and generates data D_V indicating the current vehicle speed. The microcomputer 14 reads map data M from the a CD-ROM drive 13 on the basis of the inputted data D_G, executes map-matching the data D_G with the map data M, and generates display data D_D for displaying the current position of the vehicle on the map. The display 15 displays the current position of the vehicle on the map by using the display data D_D supplied from the microcomputer 14.

The GPS receiver 11 will be described in detail with reference to FIG. 2. The antenna 11A is coupled to a GPS receiving unit 40 via a preamplifier 31 and a band-pass filter 32. In addition to these structural elements, the GPS receiver 11 is provided with an operation unit 20, a crystal oscillator 35, a clock generator 36, and a signal processing unit 37. A frequency mixing circuit 41 generates a signal having the same pattern as data relating to a carrier of the GPS satellite, the position thereof, and a clock built in the GPS satellite. The crystal oscillator 35 generates a reference frequency signal, which is a reference timing control signal of the GPS receiver 11. The clock generator 36 generates, from the reference frequency signal, a clock signal for controlling operation timings of the signal processing unit 37. The operation unit 20 is connected to the signal processing unit 37 so as to generate the GPS data D_G on the basis of the output of the signal processing unit 37.

A code generator 42 receives the clock signal generated by the clock generator 36, and generates a code signal having the same pattern as a distance measurement signal from the GPS satellite on the basis of the clock signal. A data/carrier detector 43 synchronously or mutually detects, by using the output signals of the frequency mixing circuit 41 and the code generator 42, data relating to the clock built in the GPS satellite and an orbit of the GPS satellite, and the carrier. A code lock detector 44 synchronously detects the above-mentioned distance measurement signal by using the code signal generated by the code generator 42.

A description will now be given, with reference to FIG. 3, of the operation of the on-vehicle GPS navigation system.

In FIG. 3, the GPS position measurement data D_G outputted from the GPS receiver 11 is applied to the microcomputer 14 as shown in FIG. 1 at each predetermined position measurement timing (step S1). The vehicle speed data D_V outputted from the vehicle speed sensor 12 is also applied to the microcomputer 14 at each predetermined position measurement timing (step S2). Then, the microcomputer 14 determines whether or not the GPS position measurement data D_G is received (step S3). When it is determined that the GPS position measurement data D_G is not yet received (NO), the microcomputer 14 executes step S3 again.

When it is determined, in step S3, that the GPS position measurement data D_G has been received (YES), the flow branches to the step S4. The microcomputer 14 determines, by referring to the vehicle speed data D_V, whether or not the vehicle is maintained in the stationary state (step S4). More specifically, in step S4, the microcomputer 14 determines whether or not the vehicle speed data D_V indicates zero or a value nearly equal thereto.

When it is determined, in step S4, that the vehicle is maintained in the stationary state (YES), that is, when the vehicle speed data D_V indicates zero or a value nearly equal thereto, the microcomputer 14 does not update the current position of the vehicle with new GPS position measurement data D_G. That is, the microcomputer 14 executes the map matching with the map data M by using the previous GPS position measurement data D_G, and outputs the display data D_D to the display 15 (step S6). Hence, the current position of the vehicle is indicated on the map displayed on the display 15 without changing or fluctuating the current position displayed thereon (step S7).

When the vehicle is moving (NO) in step S4, that is, when the vehicle speed data D_V is equal to neither zero nor a value nearly equal thereto, the microcomputer 14 updates i.e, replaces the new GPS position measurement data D_G with the GPS position measurement data D_G stored in a built-in memory (not shown) (step S5). Then, the microcomputer 14 executes the map matching with the map data M by using the updated GPS position measurement data D_G, and outputs the updated display data D_D (step S6). Hence, the current position of the vehicle based on the movement thereof is indicated on the map on the display 15 (step S7).

In this manner, according to the present embodiment, it is possible to prevent the display of the current position or the map from fluctuating when the vehicle is maintained in the stationary state.

A description will now be given, with reference to FIG. 4, of another embodiment of the present invention. In this embodiment, it is determined whether or not the vehicle is maintained in the stationary state by determing whether or not the vehicle pulse is detected by the speed sensor 12 in FIG. 1 within a predetermined period. It will be noted that in the embodiment shown in FIG. 3, it is determined whether or not the vehicle is maintained in the stationary state by determining whether or not the vehicle speed detected by the speed sensor 12 in FIG. 1, is equal to zero or nearly equal thereto.

In FIG. 4, the GPS position measurement data D_G outputted from the GPS receiver 11 is applied to the

stationary state when it is determined that the actual speed of the movable body is equal to approximately zero.

3. A navigation system as claimed in claim 1, wherein:
said speed data comprises a series of pulses, which are generated by movement of the movable body; and
said update inhibiting means comprises means for determining whether or not at least one pulse is generated within a predetermined time and for deciding that the movable body is maintained in the stationary state when it is determined that said pulse is not generated within said predetermined time.

4. A navigation system as claimed in claim 1, further comprising output means for outputting the latest current position data from said storage means to an output medium.

5. A navigation system as claimed in claim 1, further comprising:
map memory means for storing map data forming maps;
a display; and
control means, coupled to said storage means, said map memory means and said display, for making the display indicate the current position of the movable body indicated by the latest current position data on at least one of the maps formed of said map data.

6. A navigation system as claimed in claim 5, wherein said control means is adapted to select one of the maps in accordance with the current position of the movable body and for making the display indicate the current position of the movable body on the selected map.

7. A navigation system as claimed in claim 1, wherein said position measurement means comprises a GPS receiver.

FIG. 2

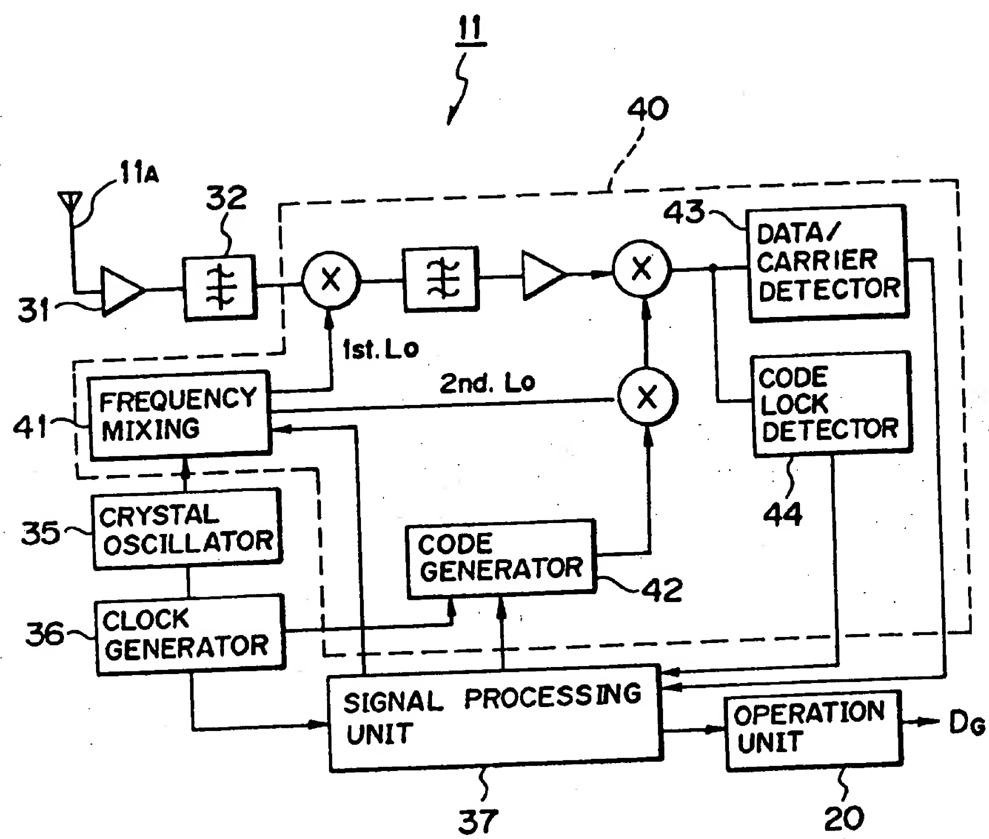
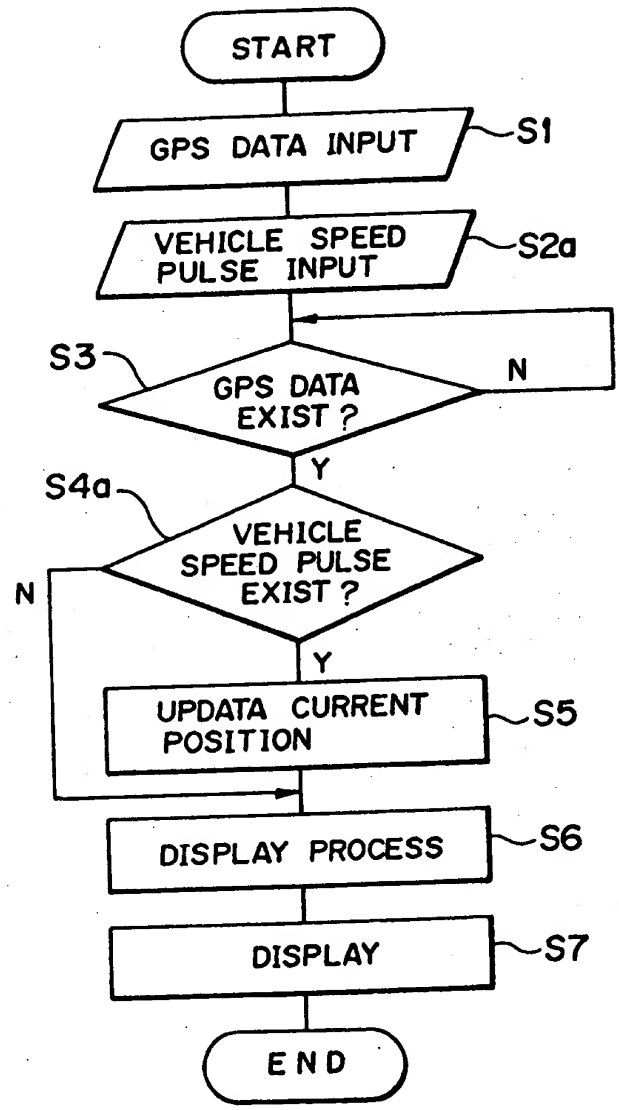

11
40
11A
32
43
DATA/ CARRIER DETECTOR
31
1st. Lo
2nd. Lo
CODE LOCK DETECTOR
41
FREQUENCY MIXING
44
35
CRYSTAL OSCILLATOR
CODE GENERATOR
42
36
CLOCK GENERATOR
SIGNAL PROCESSING UNIT
OPERATION UNIT
DG
37
20

FIG.4


START
GPS DATA INPUT
S1
VEHICLE SPEED PULSE INPUT
S2a
S3
GPS DATA EXIST ?
N
Y
S4a
VEHICLE SPEED PULSE EXIST ?
N
Y
UPDATA CURRENT POSITION
S5
DISPLAY PROCESS
S6
DISPLAY
S7
END